AD-A016 979

THE POLICY RELEVANCE OF MODELS IN WORLD POLITICS

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Prepared for:

Office of Naval Research
Advanced Research Projects Agency

October 1971

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DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1 ORIGINATING ACTIVITY (Corporate author)	2a. REPORT SECURITY CLASSIFICATION
INTERNATIONAL DATA ARCHIVE	UNCLASSIFIED
	2b. GROUP

3 REPORT TITLE

THE POLICY RELEVANCE OF MODELS IN WORLD POLITICS

4 DESCRIPTIVE NOTES (Type of report and inclusive dates)

RESEARCH REPORT NO. 7

5 AUTHOR(S) (First name, middle initial, last name)

RAYMOND TANTER

6 REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
OCTOBER 1971	55	4

8a. CONTRACT OR GRANT NO	9a. ORIGINATOR'S REPORT NUMBER(S)
ARPA Order No. 1411, ONR Contract No. N00014-67-A-0181-0042	
b. PROJECT NO	Research Report No. 7
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	

10 DISTRIBUTION STATEMENT

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11 SUPPLEMENTARY NOTES	12 SPONSORING MILITARY ACTIVITY
Department of Political Science The University of Michigan Ann Arbor, Michigan 48104	Advanced Research Projects Agency via Office of Naval Research Washington, D.C.

13 ABSTRACT

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DD FORM 1473 NOV 65

October, 1971

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Abstract of

POLICY RELEVANCE OF MODELS IN WORLD POLITICS

Raymond Tanter
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This paper evaluates the policy relevance of models according
to two criteria: 1) the degree to which policy makers may perceive they
have <u>control</u> over predictors in the model; and 2) the degree of <u>confidence</u>
policy makers may have in the model's implications. Control refers to
perceived manipulability. Confidence stems partly from the process of
combining deductive power with empirical applicability, and the extent
to which validation of the model employed multiple streams of evidence.
The paper evaluates various models applicable in world politics from
the perspective of their policy relevance. These include: game theory
models and experimental games, man-machine simulation models, aggregate
data models, and computer simulation models and information systems.

Game theory models and experimental games score relatively well on
the control criterion, but a policy maker should view them with limited
confidence. Some game models, especially zero-sum games combine deductive
power with empirical applicability, but they are not in general based on
multiple streams of evidence. Man-machine simulation models vary as to
how well they meet the control criterion. The multiplicity of variables
in some man-machine simulations lowers the internal validity because of the
inability to determine causal patterns. What man-machine simulations gain
in a closer approximation of international situations, they often lose in
precision and deductive power, and thus confidence in them should decrease.

These simulations, however, often employ multiple bases of evidence to validate implications of their models, thus lending greater confidence to the models.

Empirically oriented aggregate data models may score well on the control criterion. Many aggregate studies employ variables that are relatively easy for a policy maker to manipulate, e.g., defense expenditures. There is great variation in how aggregate data models score on the confidence criterion of policy relevance. For example, arms race models rank high because of the deductive capabilities of the arms models, while many other aggregate data models rank lower on the confidence criterion.

A problem with many of these models is that they often do not deal explicitly with the needs of the policy analyst. The study suggests that the design, development, implementation, and utilization of computer simulation models and information systems may offer a promising strategy for using social science in government. Implicit in the paper is the assumption that a closer interface between scholars and policy analysts or decision makers should produce outcomes which are more in keeping with a peaceful world than is the case today.

WHEN THE STUDENT OF POLITICS IS A <u>POET</u>, HIS SIMULATIONS OF
INTERNATIONAL RELATIONS ARE WORKS OF ART, CONSTRUCTIONS THAT
FULFILL AESTHETIC NEEDS. WHEN THE STUDENT OF POLITICS IS A
<u>SOCIAL SCIENTIST</u>, HIS SIMULATIONS OF INTERNATIONAL PROCESSES
ARE THEORIES THAT NEED VERIFICATION LIKE OTHER CLAIMS TO
KNOWLEDGE. WHEN THE SCHOLAR IS A <u>POLICY INFLUENCER</u>, HE SEEKS
TO MAKE APPLICATION OF SIMULATIONS SO THAT HE MAY GUIDE THE
AFFAIRS OF STATES AND INTERNATIONAL ORGANIZATIONS IN DIREC-
TIONS HE VALUES AND WISHES TO ACHIEVE.

(Guetzkow, 1968, p. 202)

Introduction*

The opening statement by Harold Guetzkow highlights the many roles

played by the student of politics. The poet of politics certainly plays

an important role. Indeed, he may be a major source of enlightenment for

further scientific inquiry. Similarly, the student of politics as a

scientist has a valuable role. He can build on the poet's contribution

yet adhere to criteria for scientific concept formation and theory con-

struction.

The concerns of the scholar as policy influencer, however, are

slightly different. Policy influencers should address the problem of how

their product can be applied to influence policy makers and policy analysts.[1]

Guetzkow suggests a criterion of relevance that the scholar as policy influ-

encer may use as a test for his product, to wit, whether the model allows

one to guide the affairs of state in desired directions.

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[1]The present essay distinguishes between policy influencer, policy
maker, and policy analyst. The influencer is the scholar outside of govern-
ment who is trying to apply his knowledge in order to validate it and influence
policy in desired directions. The policy maker, on the other hand, is a

Guetzkow's criterion suggests that the model's implications must be perceived as feasible by those in command prior to its application. Moreover, the criterion implies that the model must address problems perceived to be relevant by the policy makers and analysts themselves. Feasibility and applicability to current policy needs are often used as criteria for evaluating policy relevance. For example, Allen Whiting states that "...applicability to perceived policy needs is half the battle. Feasibility constitutes the other half" (1971, p. 13). Whiting, however, is pessimistic about the ability of scholars to cope with the applicability-feasibility issue.

Regarding the United States, for example, Whiting states that

Washington is far more insular in its perceptions and conservative in its estimates of the possible than most academicians appreciate. If professors are criticized for living in an ivory tower, the Washingtonian inhabits a labyrinthine honeycomb with the queen bee directing her court as they, in turn, the hive. (1971, p. 13)

Whiting's pessimistic assessment of the extent to which scholars can fertilize the queen suggests that one focus attention on the queen and her court. What can the scholar do to focus attention and involve himself in the policy process in order to influence it? The International Relations Committee of the Society for the Psychological Study of Social Issues (SPSSI) recently addressed this problem. A SPSSI report states that the scholar has the ability to supply organizing concepts which could lend coherence to

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decision maker or governmental problem solver, e.g., in the U.S., the rank of deputy assistant secretary and above. The policy analyst is a staff person to the problem solver, e.g., an intelligence analyst who has a great need for substantive information systems to retrieve, manipulate, model, and estimate the future (cf. Hilliker, 1971). The scholar as influencer normally works through the analyst rather than directly with the policy maker himself. Thus, the analyst often stands at the interface between the scholar and decision makers.

decision processes and also to help policy analysts anticipate emerging problems. In this context, models can be powerful vehicles for focusing attention on and facilitating involvement in the policy process. The SPSSI report notes that forecasting, diagnosis, and assessment also are roles scholars can play which are of relevance to the policy process.

In another attempt to define how scholars may be effective in government, Raymond Tanter, Philip Burgess and others at an International Studies Association-State Department Conference on Data Banks for International Studies developed a tentative description of problem solving and policy analysis functions. These functions are summarized in Table 1. As in the SPSSI report, the table lists the various roles a scholar or policy influencer can assume in attempting to participate in the policy process. The various information needs for each role are also specified. Note that the functions and needs of the academy and polity become blurred when one focuses on the tasks that can overlap both arenas. Using Table 1 as a starting point, it appears that there are many opportunities for scholarly involvement in the policy process.

Table 1

Tanter–Burgess et al.: Problem Solving and
Policy Analysis--Roles, Functions, and Needs

Roles	Functions	Information Needs
Evaluator or Diagnostician	1. Scorecard or program evaluation	Program goals and discrepancy indicators
Planner	2. Attention-directing or problem-identification	Early warning indicators under alternative future costs
Operator	3. Problem-solving or policy-making	Options, costs, and benefits, both foreign and domestic
Analyst	4. Case comparison and system structure analysis	Memory of actions and reactions of foreign environment
Scientist	5. Estimation of system state and rate parameters for explanation	Model-derived indicator system
Forecaster	6. Forecasting	Outputs from analysis and model-building

Criteria for Policy Relevance of Models: Control and Confidence

Table 1 describes the roles a scholar can assume to influence policy and the various functions and information needs his research can meet. It provides a point of departure for evaluating the policy relevance of various models applicable to world politics.

In the present context, models are a product of a systematic process of constructing knowledge, either by mostly deductive or primarily inductive strategies.[2] Deductive modelling emphasizes formal construction of axioms, a specification of their interrelationships, and the derivation of empiri-cally testable conclusions (cf. Riker, 1962; Richardson, 1960a; Frohlich, Oppenheimer, and Young, 1971). Inductive modelling, on the other hand, stresses the discovery of empirical regularities, a development of possible explanations of such patterns, and tests of hypotheses to provide further validation of the regularities (cf. Richardson, 1960b; Rummel, 1969; Singer and Small, 1969; Alker, 1969). Whether the strategies are mainly deductive or primarily inductive, the process of model building should be distinguished from the product of model building. The criteria of policy relevance below mostly address the product of model building. In this regard, models should be sensitive to:

1) the degree to which policy makers will perceive they have control over predictors in the model;

2) the degree of confidence policy makers will have in the model's implications.

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[2] If a body of theory about world politics were developed already, there would not be a need to dichotomize deductive and inductive strategies. The relatively undeveloped state of theory in world politics is widely ac-cepted (cf. Young, 1971). It is only in the last twenty years that modelling and the use of rigorous research methods have been seriously applied to developing theory. Given this short history of theory construction, it is necessary to attempt a mix of inductive and deductive strategies. Also, this essay distinguishes model from theory in the following sense. A model is a set of concepts that abstract a portion of the world for explanatory possibilities. The model may or may not be a valid representation of the

In this paper, control refers to perceived manipulability. Confidence stems from (a) the degree of the model's deductive power and empirical applicability; and (b) the extent to which the validation of the model employs multiple streams of evidence.

If a policy maker values a goal highly, he may perceive that he can manipulate the factors that might effect goal achievement. The degree to which a policy maker feels he can and should manipulate variables in a model may be a result of the value he places on the goal, the cost of intervention, and his capability to intervene.[3] A highly valued goal in relation to the expected cost of intervention coupled with a capability to intervene may be a dangerous situation. This situation may lead a policy maker to perceive that he can manipulate the factors which he hopes will effect the desired end, irrespective of the probability that the manipulation of these factors will effect the goal.

For example, in relation to expected costs of intervention, U.S. policy makers placed a high value on "winning" the Vietnam War, 1965-1968. They had control over a great capability for intervention; perhaps as a result, they incorrectly perceived that the actual determinants of the Vietnam War's outcome were under U.S. control.

In addition to their own untested models, U.S. policy makers may have been more interested in manipulating variables based on a theoretically

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underlying process, and the model may be deductively or inductively based. A theory, however, is a valid set of propositions linked into a deductive system. Thus, there is no such animal as inductive theory.

[3]The present essay uses the term manipulable in the sense of perceived control, given the values, costs, and capabilities of a particular policy maker. In this sense, most variables are ultimately manipulable. The crucial questions then are the _values_, _costs_, and _capabilities_ of the decision maker or scholar. Hereafter, however, the term manipulable may appear without these qualifiers, but manipulability always refers to relative manipulability.

invalid model than acknowledging the inability to determine Vietnam outcomes.
If the policy maker places a high value on winning in relation to costs, he
may decide that manipulables need not be good predictors of the desired
outcomes as long as they permit him to act; taking some action may be in
the short run politically wise although theoretically foolish. As George
Gallup (1962) stated, "I would say that any drop in popularity is likely
to come from the President's inaction in the face of an important event.
Inaction hurts a President more than anything else. A President can take
some action, even a wrong one, and not lose his popularity" (p. 34). If
action is theoretically unwarranted, however, it should be politically fool-
ish in the long-term, as witnessed by the fall of President Lyndon Johnson
in 1968 as a result of Vietnam.

Regarding the cost and capability for intervention, the policy maker
may perceive that some variables are manipulable only at great costs. For
example, consider an article by Nazli Choucri and Robert North (1971). One
of their goals is "...to distinguish between those variables that are
readily manipulable and those that are less so or are manipulable at relative-
ly higher costs..." (p. 5). In discussing possible determinants of warfare,
Choucri and North suggest that policy makers perceive that they can manipu-
late a factor such as a defense budget at less cost than they can change
attributes such as population size or technological capability of their
nations. Choucri and North find that demographic factors may be more im-
portant long-term determinants of warfare than short-term fluctuations in
defense budgets. That is, the "more costly to manipulate" demographic fac-
tors explain a greater percentage of the variation in international violence
than do the less costly to manipulate defense expenditures. Since foreign
policy decision makers often are unaware of such connections, and in any

event the demographic factors seem to be less subject to their immediate control than the defense expenditures, the tendency is for them to manipulate defense budgets and ignore demographic factors.

Recall the second criterion of policy relevance in this essay--the degree of confidence a policy maker will have in a model's implications. If a model combined deductive power with applicability, there should be more confidence in its implications. Models are likely to be accepted as relevant if they yield conclusions which are deductively based yet perceived to be applicable to the world of the policy maker. Deductive models frequently sacrifice empirical fit for logical closure; on the other hand, models based on inductive strategies often sacrifice logical closure for empirical ap- plicability. Logical closure increases one's confidence in the validity of a derived proposition. Thus, a policy relevant deductive model is likely to yield implications which are believed by policy makers. If a deductive model does not fit the empirical situation, however, this may decrease the confidence a policy maker has in its implications. Hence a second criterion of policy relevance in this essay is that models should combine deductive power with empirical applicability.

For example, deductive models of conflict behavior can be developed and then partially validated in the context of controlled laboratory experi- ments illustrating a deductive-inductive mix. The value of a deductive model is based on the level of generality it possesses due to its elegance-- its freedom from having to take into account the idiosyncracies of exogenous factors. A price may be paid, however, for this elegance. Models structured in a formal, deductive manner may be inadequate by themselves to explain most, if not all, aspects of human conflict behavior. For the concepts and

insights of a deductive model of conflict behavior to lead to a fruitful theory, they must be integrated into a broader framework, e.g., by including non-axiomatic empirical considerations.

On the other hand, inductive studies (e.g., correlational studies employing aggregate data) are in some sense closer to actual conflict situations than a deductive model of conflict. These studies also are not adequate for explaining conflict behavior. In these correlational studies causal patterns often are not specified explicitly and therefore, in attempting to manipulate variables, one may not achieve the desired goals. Or the macro-level variables being studied (e.g., urbanization, economic development, etc.) may be perceived as virtually beyond manipulation--at least in the short-run--by the policy influencer (cf. Feierabend, 1969; Gurr, 1968, 1970).

The author and Gregory Markus are undertaking work on a model of conflict behavior which seeks to combine the results of empirical research within a framework of a deductive model (Markus and Tanter, 1972; also cf. Axelrod, 1970). The deductive model assumes that actors in a conflict situation weigh the costs and benefits of various possible actions before undertaking any particular step. Actors in a conflict situation also may realize benefits which are independent of the specific goals or aims over which the conflict has arisen.

Empirical research suggests that psychological benefits such as catharsis and feelings of group identity, efficacy, self-esteem, etc., may result from participation in conflict, regardless of whether the more conscious goals of the conflict are achieved. Moreover, if one adheres to the ideas of ethologists--which are often based on inductive research dealing with animal behavior--conflict may be a necessary and inevitable process quite independent of strategic considerations. The over-all conflict model,

therefore, is based on the idea that, along with more conscious aims, other goals--psychological and even possibly instinctive in nature--may be maximized as well.

When the findings of empirical investigations can enlarge the scope of a deductive model, it usually increases the model's policy relevance. In the conflict model example above, the results of the empirically oriented studies could be used to modify the deductive model. Thus, a conflict model that reflects the empirical regularities that have been observed in these studies combines deductive power with empirical applicability.

The degree of confidence a policy maker has in a model's implications also stems from the utilization of multiple streams of evidence in the model building enterprise.

Models should utilize multiple streams of evidence in order to increase the probability of valid inferences. Models which are linked to single types of evidence have more threats to their validity than those grounded in multiple bases of evidence. For example, models based on experimental evidence alone may be externally invalid but internally valid, e.g., there may be threats to the generalizability of the model from the laboratory to the external referent, but the laboratory controls decrease threats to internal validity. On the other hand, models based upon sample survey data may be externally valid but internally invalid. The survey based models may use randomly selected samples of large populations in order to increase the representativeness or external validity of the model. The surveys may not be internally valid in that some differences can be explained away as artifacts of the survey itself, e.g., the process of interviewing may produce "reactions" with the respondents which invalidate the responses (cf. Campbell and Stanley, 1963; Webb, et al., 1970; Kerlinger, 1964).

Thomas Milburn (1971) employs a criterion of policy relevance similar
to the multiple streams of evidence rule of this essay. He states that in
utilizing scientific data in the policy process it is important to use
multi-method research strategies. From experimental design considerations,
multi-method research strategies insure that empirical support for a model
is not merely a function of the researcher's expectations or the method
employed in testing it. Milburn also points out that research based on
multiple streams of evidence or different methods of validation is well-
suited to the diversity of backgrounds found among policy analysts. They
may have been historians, area specialists, or behaviorally oriented social
scientists before entering the government. Models tested with various
methods and types of data, therefore, have a good chance of being accepted
by policy analysts.[4]

With the control and confidence criteria as guides, this essay attempts
a critical evaluation of the policy relevance of various types of models.
The essay makes an effort to pinpoint those models which offer promise for
using social science products in government. The control and confidence cri-
teria are not exhaustive of the criteria that could be used in identifying
policy relevant models. The control and confidence criteria describe con-
ditions that may enable a model to bridge the gap between social science
and government. It is not necessary for both criteria to be satisfied for

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[4]If there were theories of world politics developed already, there
would be less need for multiple streams of evidence, but rather more need for
an economy of evidence. In the present state of the model building enter-
prise, however, it is necessary to employ multiple streams of evidence to
decrease threats to valid external inferences and thereby increase the
confidence policy makers have in the resulting model. In model building,
one often makes an effort to construct and confirm a pattern of statements
applicable across time and space. A model based on multiple streams of
evidence insures that a particular model is more general than the situation
specificity of models that depend on only one stream of evidence.

a model to be policy relevant to some degree; it may be that only one of the criteria is met in a given situation.

Imagine a model in which a policy maker has confidence because it: (1) combines deductive power with empirical applicability; (2) is based on multiple streams of evidence; but (3) does not employ manipulable variables. This model might permit one to forecast with high confidence the fluctuation in a variable over which one has no control regardless of cost. This forecast might allow a policy maker to make plans which, although not affecting the variable in question, might mitigate its effect. For example, earthquakes often are not predictable in advance. Nonetheless, areas where they frequently occur have developed standard operating procedures for processing the injured, alleviating congestion, and communicating in the absence of normal channels. Thus, if an event cannot be stopped or changed, vulnerability to it may be decreased.

Prior reviews of the literature often focus on the confidence criterion but give little attention to the control criterion of policy relevance. For example, Richard Snyder's (1962) excellent review of trends in the world politics literature deals with deductive and inductive styles but provides little insight into the policy relevance of these approaches. In addition, James Robinson's (1970) perceptive critique of the literature on crisis decision-making focuses on concepts, models, hypotheses, and techniques of analysis. Although Robinson deals explicitly with the policy process and is thus policy relevant in a general sense, his essay does not employ the control criterion of policy relevance used in this essay. Whiting (1970) provides a further contribution regarding policy processes in general but may not be policy relevant according to the control criterion of this essay.

Whiting suggests that the tasks of the political scientist are "... to determine the [policy] process, to discover its shortcomings, and to designate means of improvements" (p. 34). Only if the policy process yields models whose variables are relatively manipulable, for example, would the Whiting suggestion result in policy relevant research according to the control criterion of this essay.

Thus far, this essay implies that closing the gap between social science research and government policy depends basically on the research meeting various policy relevance criteria. It is essential to note that the relationship between research and policy also depends upon the stage of the policy process. Quite different tasks face policy analysts and policy influencers as a policy problem progresses from one stage to another. There are variations in what is policy relevant depending upon the particular phase of the problem. Charles Hermann (1971) outlines five more or less prominent analytical stages of the policy process. These stages include 1) problem recognition; 2) problem and option definitions; 3) option advocacy; 4) implementation; and (on occasion) 5) evaluation. These policy stages and the outputs from the social sciences that are relevant at each stage are summarized in Table 2. The model building efforts to be discussed, to the extent that they are relevant according to the proposed criteria, are probably most useful to the policy analyst in the first three of Hermann's stages. An attempt will be made to indicate to what stage of the policy process each model building effort is most applicable.

What follows are some illustrations of models in world politics from the perspective of their policy relevance. There is no pretense at completeness in the evaluation; rather, the models selected are illustrative of broad trends. Models based on game theory and experimental games, man-machine

simulations, aggregate data, computer simulation models and information
systems constitute the categories for evaluation.

TABLE 2: Hermann's Policy-Making Stages*

Kinds of inputs
from social
sciences

1. Problem/Task Recognition

case studies
description accounts
projections and forecasts
historical analogies
trend analysis

2. Problem and Option Definition

data banks
information retrieval capabilities
systems analysis
multivariate analysis
partial regression equations

3. Advocacy of Options

anything that relates one
option to an indicator of
policy objectives differ-
ently from other options
--simple correlations,
tests of significant dif-
ferences, simulations, or
laboratory experiments

Kinds of inputs
from social
sciences

4. Implementation

organizational and adminis-
trative studies
personnel selection pro-
cedures
survey research
PPBS

5. Evaluation

social indicators
definitions of policy outputs
surveys
comparative case studies
item construction
scaling techniques

*Constructed from Hermann (1971). Hermann's complete table includes bureaucratic concerns, conditions increasing receptivity to research, and channels for transmitting social science inputs for each stage of the policy process.

Policy Relevance of Game Theory Models and Experimental Games

Game theory involves several models. The model of zero-sum games is the most formally developed mathematically. This model has been frequently criticized as not being applicable to most bargaining situations because it assumes that the players' interests are directly antithetical. What A wins, B loses, and vice versa.

William Riker (1962) developed a zero-sum model of coalition behavior. In addition to the zero-sum situation, Riker assumes rationality and perfect information among other limiting conditions, to deduce the size principle: coalitions tend to be of minimal size necessary to win. Critics of Riker often attack the zero-sum assumption as being unrealistic in relation to world politics. Nevertheless, Riker's model yields an empirically testable proposition concerning the minimal size of coalitions. According to the control and confidence criteria of this essay, Riker's model comes off with a relatively high rating.

The assumptions of Riker's model generally are not under the control of policy makers, e.g., one can rarely perceive that he can manipulate the zero-sumness of a strategic situation. Moreover, there are limitations on the degree to which policy makers can make rational decisions, and thus, the model's assumption of rationality may not be subject to control. On the other hand, an implication of Riker's model may be perceived as manipulable, e.g., the extent to which policy makers decide to include additional members in their coalition.

With respect to confidence, Riker's model receives a high mark for deductive power with empirical applicability, but a lower rating for multiple streams of evidence. Given his assumptions, the size principle follows according to rules for valid inference--illustrating deductive

power. The **size principle** itself has high empirical applicability. Riker and his colleagues illustrate the size principle in different situations of coalition formation, including experimental games, political parties and international empires (also cf. Groennings, et al. 1970). The wide range of empirical materials in which they illustrate the size principle results in a moderate mark on the multiple streams of evidence criterion.

A lack of concern with experimental design criteria, however, mars much of the research on the size principle. There often are inadequate controls for extraner variance in designing tests of the size principle; thus, there are several rival hypotheses which also may explain the size principle besides the Riker model. Nevertheless, Riker's model probably ranks at the top of game theory models on the basis of the control and confidence criteria of this essay.

Where Riker's model assumes a zero-sum situation, there are non-zero-sum models that may be less policy relevant in certain respects, but more relevant in other respects. For example, a non-zero-sum model often loses logical closure and thus deductive power. The non-zero-sum assumption, on the other hand, is a closer approximation to bargaining situations in world politics. That is, a typical situation in world politics is where actors have both competitive and cooperative interests. Thus, the non-zero-sum model ranks lower on deductive power but higher on empirical applicability than the zero-sum model. Regarding the control criterion of policy relevance, the non-zero-sum and zero-sum games seem equal. Where the assumptions in the models themselves may not be perceived as highly manipulable, the models' implications may be thought of as manipulable. One way of exploring implications of a game theory model is to use experimental gaming.

Thomas Schelling (1961) states that the reason one uses experimental
games is that game theory is inadequate by itself in a study of bargaining
processes. He concludes that experimental games contain an element of
indeterminancy that better reflects the world than game theory alone. Anatol
Rapoport (1960), moreover, cautions against the misinterpretation of experi-
mental evidence regarding game theory: "...classical game theory is not
based on experimental evidence. It represents an attempt to build a norma-
tive theory on a foundation of strategic logic" (p. 224, emphasis in original).
Experimental gaming, nevertheless, might provide some evidence for or against
the implications of deductive models. The Journal of Conflict Resolution
contains much of the literature on experimental gaming, some of which is
set within the context of non-zero-sum game models. The prisoner's dilemma
experiments, for example, constitute an important set of studies in this
literature.

Game theory provides a formal deductive base for experimental gaming.
A policy maker can have some limited confidence in these experiments based
on game theory since they are illustrative of an initial attempt to combine
deductive power with empirical applicability (e.g., the experiments). Confi-
dence in game theory models, however, is lowered if laboratory evidence is
the only type of evidence for evaluating the implications of the models.
These experimental studies sacrifice external validity (generalizability)
for internal validity (tight controls to eliminate rival hypotheses).

Generalizing the results of experimental games to domestic or inter-
national political situations can be misleading. A laboratory setting can
place serious constraints on the realism of the situation invoked. For
instance, many game situations neglect the psychological make-up of the
participants, which may be of importance in determining outcomes. As

Rapoport (1960) notes, there is more to winning a game than simply the amount in the pot. "There is the jingling of the coins, the admiration of the onlookers, the feeling of being lucky, etc." (p.121).

Rapoport (1968) states that there is a great deal to be learned about the dynamics of interaction through the playing of experimental games. He believes, however, that it is too early to raise the question of the applicability of the results of these mixed-motive games to mixed-motive conflicts in world politics. Hasty extrapolation may lead to faulty conclusions or perhaps to forsaking the laboratory games for more "realistic" arrangements. "What is worse, viewing the laboratory methods in terms of simulation of real life conflicts leads to designs which are not guided by the inner logic of a systematic investigation" (p.469). Only when the empirical generalizations have become stabilized into a model of the 2X2 game situation should the relation to international conflicts be considered. There is also a limited range of results that can be obtained in any set of experimental game situations. For example, Rapoport (1968) notes that thousands of experiments must be performed to collect a data base that can yield a description of how the choices in a prisoner's dilemma 2X2 game are influenced by the payoffs.

Some of the basic independent variables that are used in experimental gaming are the payoff matrix, time, characteristics of the players, and the strategy of the other player. In terms of policy relevance, the most interesting findings may concern the various strategies used in the game. Strategic behavior is the most manipulable variable for a policy maker. In an international bargaining situation, it is not usually possible to manipulate the payoff matrix, time, or the characteristics of the other partici-

pants, but it may be possible to manipulate the s'rategy used for one's own nation. In this regard, one interesting and consistently reported finding is that simple contingent strategies, particularly a tit-for-tat strategy on the part of the experimenter's confederate, tend to push the subject toward cooperation (Rapoport, 1968).

Lxperimenters design 2X2 game situations in such a tight fashion that the game's generalizability must suffer. The process of validation occurs partly through manipulating a selected number of independent varia- bles and assuming that all other variables are either controlled or randomly distributed. The obvious problem is that in an international bargaining situation it may be impossible to control these variables or to assume that they have an unbiased distribution. Most models used in experimental gaming do not fit the empirical situation and thus decrease the confidence a policy maker will have in their implications. The models may orient the policy maker to evaluate his problem in different terms and/or they may suggest new perspectives from which to view the policy situation, but they also may mislead the policy maker.

With reference to Table 1, the information provided by a scholar who uses game theory models may be useful to the evaluator or the diagnostician. Game theory, despite its usual level of abstraction, has been extremely helpful in the formulation of problems and the clarification of concepts (Schelling, 1963). Game theory models and experimental gaming also might be useful to the planner or the operator. These users are motivated by the need for substantive information such as options, costs and benefits--both foreign and domestic. Game theory models might be most helpful to these users in the problem/task recognition stage or the problem and option definition stage of the policy process (see Table 2). These stages consist of periods of search for information about a problem and possible responses to it that

are unbiased by previously determined policy options.

In summary, game theory models and experimental games score relatively well on the criterion of control, but a policy maker should view them with mixed confidence. That is, some models combine deductive power with limited empirical applicability, but they are not in general based on multiple streams of evidence. On the other hand, some games sacrifice deductive power in order to achieve more empirical applicability, but the game's inferences may suffer from inadequate attention to the multiple streams of evidence criterion.

Policy Relevance of Man-Machine Simulations

There are other laboratory studies not tied as much to game theory as some of Riker's and Rapoport's work. These other studies sacrifice additional logical closure of the deductive game model for more empirical applicability. Gerald Shure and his colleagues (Shure, Meeker, and Hansford, 1969), for example, have studied bargaining situations with more face validity regarding world politics than the simple prisoner's dilemma experiments. Like the prisoner's dilemma bargaining situations tied more closely to game theory, the Shure studies deal with manipulables and thus address one policy relevance criterion relatively successfully.

For example, Shure and his associates manipulated the experimental conditions related to the character of a pacifist via a simulation design. They also manipulated the communication network and provided the opportunity for direct exchanges of messages above and beyond that information communicated by overt game moves. The experiment also provided for the unwarranted use of power at any time during the game situation. The Shure et al. studies thus deal with variables that could be manipulated by policy makers if the results of bargaining experiments were extrapolated to international bar-

gaining situations. The Shure et al. experiments grew out of an earlier
series of studies that concerned threat availability and psychological fac-
tors in conflict escalation. The authors found that the pairing of a
cautious, well-intentioned bargainer with an aggressive bargainer led to
greater loss and disruption than that occurring between pairs of equally
matched partners. The simulated pacifist studies were done in an effort
to identify those features of bargaining that prove to be beneficial or
detrimental in the realization of a cooperative bargaining outcome.

These studies illustrate a limited attempt to build models in which
a policy maker could have confidence. That is, they combine a limited
deductive power with empirical applicability. They seem to be great de-
partures from formal game theory because of the relaxed assumptions neces-
sary to construct the bargaining situation. These models, however, are
an example of an attempt to gain policy relevance using the results of
empirical investigations to modify the more deductively oriented experi-
mental bargaining games of the Rapoport variety. Although the propositions
tested in the Shure et al. studies are not explicitly drawn from formal
game theory, the information gained might be useful in future model build-
ing because it systematically reflects some of the conditions of an inter-
national bargaining situation.

Laboratory studies, such as these man-machine simulations, intro-
duce even more complexity into the situation than the simple experiments
in order to gain additional external validity. A man-machine simulation
generally combines human functioning in political and economic roles with
computer programs or other constraints on their activity. In a typical
man-machine simulation run, a large number of subjects are grouped into

fictitious nations in a laboratory representation of certain aspects of world politics (cf. Guetzkow et al., 1963). Such aggregations allow for the study of more macro-level processes as alliance cohesion and warfare. For example, an important tentative finding from one such study (Brody, 1963) is that after the spread of nuclear weapons, the former non-nuclear nations may be as likely to communicate outside their own bloc as with their own bloc leader; that is, bipolarity tended to give way to multipolarity after the spread of nuclear weapons.

As noted above, what the man-machine simulations gain in a closer approximation of international situations they often lose in precision and deductive power. These studies, however, are not without some logical closure from the introduction of an explicit model which operates as a simulation of international processes. The operation of a simulation model produces consequences which are implications of the programmed constraints and the behavior of individuals who may be participating. The consequences, however, are not calculable in advance as with a deductive model such as Riker's since the variables in the simulation interact in an unknown way. Hundreds of interactions produce consequences of an indeterminate nature.

Man-machine simulations vary in how they meet the confidence criterion of multiple streams of evidence. A policy analyst, for example, may have little confidence in the Shure et al. experiments because, like other laboratory studies, they draw solely on experimental data. There is little attempt to validate the laboratory based conclusions using data from such arenas as arms control negotiations. On the other hand, Harold Guetzkow and his colleagues have found some correspondence between their simulations and empirical material drawn from a variety of different data

bases (Guetzkow, 1968; Hermann and Hermann, 1969). As a result, the policy relevance of their Inter-nation Simulation and related models is greater than that of the simple laboratory experiments (cf. Coplin, 1968; Coplin, O'Leary, and Mills, 1971).

The man-machine simulations exceed the simple laboratory studies in the sheer number of manipulables available, and thus at first blush may rank ahead of the latter on this policy relevance criterion. There may be design problems in a model with many manipulables, however. Parsimony dictates an economy of indicators in the model building enterprise, although a variety of types of evidence is necessary to gain external validity. In addition, the multiplicity of variables in man-machine simulations lowers the internal validity because of the inability to isolate causal processes from extraneous forces.

In summary, man-machine simulations score relatively well on the control criterion of policy relevance, even though too many manipulables may create some difficulties. These simulations vary as to how well they meet the confidence criterion. In general, the models attempt to combine limited deductive power with empirical applicability. The studies evaluated above lose policy relevance as they sacrifice logical closure, but gain relevance as they become more empirically applicable. Considering the second half of the confidence criterion, some man-machine simulations have been partially validated using multiple streams of evidence, while others are still tied only to one source.

As with the models based on experimental gaming, man-machine simulation models could probably be most useful in the problem and option definition stage of the policy process (see Table 2). To the operator or the

planner at this stage, models with manipulables provide for the formulation of alternative responses to a problem (see Table 1). Models which meet the control criterion also may aid in recognizing and structuring the policy problem.[4a]

Policy Relevance of Aggregate Data Models

Laboratory studies constitute one strategy for model building. Aggregate data studies represent another basis for model building. Although the great quantity of aggregate studies are mainly inductive in their orientation, there are some deductive type models that yield empirically testable implications about world politics. The arms race literature abounds with illustrations of studies employing a deductive strategy of modelling. Based on a fundamental model set forth by Lewis Richardson (1960a), the arms race studies are at once theoretically significant and policy relevant. The theoretical and policy nature of the Richardson process model derives from its assumptions concerning the conditions under which defense planners increase or decrease the level of their armaments:

1) Defense planners will predicate changes in their armaments based upon some constant proportion of the level of their opponent's armaments.

2) Owing to the expense of maintaining arms, they will decrease at some constant proportion of the existing force level.

[4a] The discussion above does not explicate the man-machine models themselves in the presentation of the simulations. For example, the Inter-Nation Simulation has a particular model of foreign policy decision making that emphasizes domestic constraints on policy while international system factors are unprogrammed.

3) Armaments will increase or decrease at a constant rate depending upon the dispositions defense planners have towards other countries, e.g., arms increase if there are feelings of hostility and decrease if there are feelings of amity.

4) The above three conditions are additive.

Formally, this can be modelled for the two country case as:

Country A $\quad \frac{dx}{dt} = ky - ax + g$,

Country B $\quad \frac{dy}{dt} = lx - by + h$,

where x and y represent the armament expenditures for country A and B respectively; $\frac{dx}{dy}$ is the rate at which country A arms, while $\frac{dy}{dt}$ is the corresponding rate for country B; k and l are the defense coefficients for each side respectively, e.g., the higher the k, the more country A is influenced by the amount of armament of country B; a and b are the "fatigue and expense coefficients" and g and h are dispositions, e.g., hostility or amity.

Some consequences of these equations for the policy analyst are in their properties as a system of first order differential equations. Presumably, the policy analyst would be interested in those conditions under which the system is in equilibrium, rather than those which would lead to an unlimited increase in the level of armaments. Logically, the system would be in equilibrium when the rate of change of armaments would be zero for both sides. This occurs under the following condition:

$$kl \; < \; ab$$

which can be derived mathematically from the original set of equations. Note, for instance, that the dispositions for the two countries have no effect upon whether the system is stable or unstable, although they do determine the location of the equilibrium point.

A policy maker's initial reaction to this model might be to conclude that this form of social determinism leaves no room for rational policy choice; that is, once the coefficients are set, the process will lead to an unlimited increase in armaments (an impossibility) which will lead inevitably to war. Richardson himself inadvertently encourages such an interpretation by stating that the outcome of his model "...is what would occur if instinct and tradition were allowed to act uncontrolled" (1960, p. 12; also cf. Rapoport, 1960, pp. 15-107; 1957, pp. 249-299; Boulding, 1962; Smoker, 1969, pp. 573-582; and McGuire, 1965).

As Richardson himself points out, however, it is one thing to describe a process in terms of a deterministic mathematical model as illustrated by equations. It is quite another thing to conclude that policy makers have no freedom to alter the manipulables under their control and thereby dampen the arms race. The obvious manipulables in the arms race are the coefficients themselves. That coefficient most under the defense planner's control is the defense coefficient (k or l). By reducing this to zero and thus not reacting to his opponent, the defense planner unilaterally would preclude the possibility of an arms race.* The dispositions are not readily manipulated by the defense planner, nor are the fatigue and expense coefficients.

Regarding the two criteria of policy relevance considered here--control and confidence--the Richardson model does relatively well. Having discussed control above (unilateral cessation of the arms race by setting one's rate of increase at zero), consider the Richardson model from the perspective of con-

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*Thanks to Michael Mihalka for this interpretation.

fidence: deductive power with empirical applicability and the use of multiple streams of evidence in the model validation process.

The equations do yield deductive implications with high empirical import; hence, the Richardson model should have consequences which command some of the confidence of policy analysts and defense planners. Richardson, however, restricts himself to defense expenditures as indicators of arms races and fails to employ multiple indicators of the arms process. Hence, the Richardson model receives only a moderate rating on the confidence criterion of policy relevance.

Arms race studies use aggregate data for the purpose of empirically validating deductive implications from mathematical models of the arms process. There are other studies that use aggregate data as evidence to test the implications of formal models. For example, the study of Mancur Olson and Richard Zeckhauser (1968), "An Economic Theory of Alliances," uses a collective goods model to explain the sharing of defense costs within NATO. The deductive aspects manifest themselves in the derivation of empirically testable propositions from the collective goods model; the empirical aspects manifest themselves in the comparative statistical analysis across NATO member countries to test implications of the model.

A principal implication of the model is the tendency for larger members of an alliance--those that place a higher absolute value on the public good--to bear a disproportionate share of the burden, e.g., alliance defense costs. As anticipated, the empirical tests find a positive correlation between the size of a member's national income and the percentage of its income devoted to the common defense. The model explains this finding in part from the fact that each ally must share the benefits of any additional

increments of the collective good with all others while bearing the full marginal cost. Thus, there is a strong incentive for any individual member to stop providing the collective good long before the group reaches a point of relative equality of burden sharing.

On the control aspect of policy relevance, the Olson and Zeckhauser study ranks high because it deals with defense expenditures, a variable that is relatively easy to manipulate. On the confidence criterion, the study does moderately well. The model has deductive power through the derivation of empirically testable propositions and empirical applicability in the comparative statistical analysis across NATO member countries. The collective goods model is applied to a diverse set of empirical materials, thus addressing the multiple streams of evidence aspect of the confidence criterion of policy relevance.

The inductively oriented aggregate data studies are much more plentiful than the deductive strategies. The inductive studies often provide an opportunity for a clear demonstration of the control criterion of policy relevance: one can identify and rank the variables in the model as to their relative degree of manipulability.[5] Consider a study using aggregate data by Masakatsu Kato (1969). Kato uses such variables as alliance affiliation, Communist threat, geographical location, and Soviet trade to predict U.S. foreign aid allocations, having developed his theoretical expectations on the

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[5] Consider the following hypothetical example of an empirically oriented policy analyst suggesting a model to a policy maker who has already made his mind up to act with or without theoretical justification. Let the policy analyst present a model containing both manipulables and variables that are controllable only at high cost to the policy maker. Imagine that the "costly to manipulate" predictors explain some 80% of the variation while the easy to manipulate variables explain only 5%. The policy maker may ignore the variables that are too costly; when he does decide to take action, he may inter-

basis of a rational decision-making model. In one of the regression analyses, he finds that geographical location is one of the better predictors and that Soviet trade is one of the poorest predictors of total U.S. assistance allocated to a nation. Imagine that Kato as an influencer of policy presented his modelling to a Soviet policy analyst whose task it is to analyze trade as a counter to U.S. influence in less developed countries. The respective policy maker probably would shrug his shoulders and proceed with business as usual when told that he is not likely to have an effect by intervening via trade. When confronted with no decrease in U.S. assistance as a result of increased Soviet trade to a less developed country, his response may be to increase the level of trade to obtain the desired effect.

Regarding the confidence criterion, Kato creatively uses aggregate indicators to make inferences about unmeasured concepts characteristic of a rational decision-making model. The attempt to employ deductively oriented concepts and models and tap them through aggregate indicators places the Kato study near the mid-point of the deductive-inductive continuum, on the inductive side. Finally, Kato's study ranks low in multiple streams of evidence because he uses aggregate data exclusively. A policy analyst, thus, should have only moderate confidence in Kato's model and its implications.

The aggregate data models of Richardson, Olson-Zeckhauser, and Kato may be useful to a policy planner or operator in his delineation of policy options (see Table 1). Olson and Zeckhauser's model, for example, seems

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vene via the factors that should have only about a 5% effect on the outcome. The policy analyst should warn the decision maker that he will not have the desired effect by intervening via factors that explain only 5% of the outcome variable. The policy maker's response might be as follows: to fire his analyst and state that, "POLITICS IS THE ART OF THE POSSIBLE--NOT THE PROBABLE: INTERVENE WHERE POSSIBLE EVEN IF THE DESIRED OUTCOME IS NOT PROBABLE." (Tanter's First Law!)

particularly relevant to the weighing of costs and benefits of alliance burden sharing alternatives. Richardson's model, in addition, would be useful to the policy scientist, who needs a model derived indicator system for estimation purposes.

Similarly, the aggregate data models relate to the problem and option definition stage of the policy process (see Table 2). They are also useful in Hermann's third stage, option advocacy. In this policy phase, the range of options are narrowed and the question becomes one of choosing which of a small number of options has a more desired effect on the condition. In this stage, the policy analyst seeks information that demonstrates a relationship between a variable present in one option and some indicator of the objective. Aggregate data models seem quite able to supply such information.

Policy Relevance of Computer Simulation Models and Information Systems

Aggregate data also can be used in the validation of computer simulation models. Where the simulation experiments discussed earlier consist of a man-machine interface, the work by Hayward Alker and Cheryl Christensen (1970) is an all-machine or computer simulation. Their model of UN peacemaking success and failure consists of: 1) a computer program that simulates the UN Charter to define UN involvement; 2) a formal process model of a precedent logic decision making procedure; 3) a statistical model for explaining and predicting UN success and failure on the basis of actual or hypothetical involvement roles; and 4) a set of mechanisms for revising operational expectations, procedures, or system rules.

The model operates through precedent search. Precedents are found by matching on the following five characteristics of disputes: existence of

hostilities, UN organization involved (determined by the Charter), degree of major power involvement, type of issue, and period--general power configuration. The model also resolves conflicts in the simulation by providing for two measures of success: the extent to which the UN settles or helps to settle a dispute and the extent to which it stops hostilities.

An assumption of the Alker-Christensen model is uncertainty avoidance. The UN Charter is viewed as reducing uncertainty by specifying a behavioral repertoire of coercive and non-coercive events. Assumptions of organizational learning and forgetting also are employed in the model as Charter based expectations are modified by experience. The authors state that if their model is a valid one, they can reconstruct prior histories and explore future possibilities.

The model partially meets the control criterion of policy relevance because it allows for varying the levels of involvement called for in the Charter and actually found in historical cases. Results of a related study by Alker and Greenberg (1970) using the model suggest that the UN could have done better even while maintaining a limited type of veto, if participating states would have agreed to a more activist UN role. Admittedly, the UN Charter cannot be manipulated except at great costs. Charter reform, however difficult, does provide a potential policy influencer with an ultimate goal on which to focus his efforts.

The Alker-Christensen model receives some empirical support from aggregate data on collective security disputes before the UN, 1945-1965. The model thus meets half of the confidence criterion of policy relevance--it has some deductive power with much empirical applicability. It may be more difficult to convince policy analysts of the relevance of an all-machine simulation because the model has not met the second half of the confidence criterion--multiple streams of evidence. That is, the model must be validated

further with different types of data on the relevant disputes. This model, with its precedent search component, would be useful to the operator in problem-solving or policy-making as well as to the analyst in case comparison and system structure analysis (see Table 1). This computer simulation model could be most helpful in the problem and option definition or the option advocacy stages of the policy process (see Table 2).

Game theory and experimental games, man-machine simulations, aggregate data, and some computer simulations employ models that the scholar could adopt with more or less success (mostly less) in his effort to influence the affairs of state. A problem with many of these strategies is that they only address problem-solving and policy analysis functions in a limited way. For example, the Richardson process model intends first to be a contribution to theory; although it was important for Richardson personally, the policy aspects of his model are secondary to the theoretical contribution. Even then, however, the Richardson model still stands out as one of the most policy relevant ones considered. By computerizing its model, the Alker et al. simulation is a general improvement over the Richardson model. A related computer based strategy could be even more policy relevant than Richardson's model because of explicit attention to policy activities. Consider, for example, a list of policy activities devised by Davis Bobrow (1971). This list includes tasks, requirements, and products of policy activities, which are summarized in Table 3.

Lincoln Bloomfield and Robert Beattie (1969) were among the first to design a system around policy analysis functions and needs (e.g., the types presented in Tables 1 and 3). They created a computer based model and information system: CASCON--Computer Aided System for Handling Information on

Table 3*

Tasks	Requirements	Products
1. Reporting	a. Observers b. Communication network c. Search instructions	a. Central collections of observations
2. Monitoring implementation	a. Guidance records b. Behavior records c. Compliance indicators d. Software	a. Performance-guidance discrepancies
3. Evaluating policies and programs	a. Criteria measures b. Policy/program history c. Before and after records d. Software	a. Policy impact judgments (direction, amount, rate)
4. Anticipating environments	a. Historical patterns b. Models c. Software	a. Estimates (descriptions of the future)
5. Policy design	a. Explicit alternative courses of action b. Criteria measures c. Models d. Resource inventories e. Estimates f. Policy history g. Policy impact history h. Performance-guidance discrepancy history i. Software	a. Programs

*From Bobrow (1971a)

Local Conflicts.   CASCON provides policy planners and analysts with a computerized mechanism to help them manage local conflict situations.

CASCON rests on a number of assumptions which together constitute a partical model of local conflict.   The assumptions are as follows:

(1) Local conflicts have a general, common structure rather than being always unique and random phenomena.

(2) All conflicts go through a preliminary dispute phase and one or more of three basic conflict phases--Phase I (dispute, pre-hostilities, pre-military), Phase II (pre-hostilities but dispute seen in military terms), Phase III (hostilities), Phase IV (Post-hostilities, but military option remains), Phase V (post-conflict, but dispute remains), and Settlement of dispute.

(3) In each phase, factors can be identified that generate pressures tending to push the conflict across a threshhold of transition into another phase.   These factors may be countered by other factors that can be regarded as tending toward the prevention of that transition--or generally toward Settlement.

(4) Changes in the relationship among these specific factors will alter the likelihood of a conflict undergoing transition from one phase to another.

(5) The course of local conflicts can be significantly altered by policy measures aimed at reinforcing violence-maximizing factors and offsetting violence-generating factors, on the basis of "conflict-specific" factors identified for the phase in question.

CASCON addresses nicely the policy relevance criterion of control. Although a major power policy maker may have little or no control over the factors of a local conflict (e.g., the parties are historic enemies), they do have significant control over their policy measures which may affect the outcome of a local conflict.   For example, one measure that can offset a conflict factor is to place stronger pressure on all parties to resolve the dispute bilaterally or accept compulsory third party settlement through international organization procedures.

CASCON does not score as well on the second criterion of policy relevance--confidence.   Although it has empirical applicability, a policy maker

may not have great confidence in its propositions because they are not logical

consequences of an underlying deductive model. CASCON does employ a limited

phase model of conflict; that is, CASCON assumes that any conflict passes

through several stages. There is not, however, an explicit formal model

underlying CASCON; rather, it is basically an information storage and retrieval

system designed to help the planner and analyst be creative in his work.

CASCON contains a data base of some 400 factors on over 50 cases of

local conflict. Government and area experts coded the factors for each case.

In its present stage of development, CASCON does not satisfy the multiple

streams of evidence portion of the confidence criterion for policy relevance.

CASCON developers, however, may expand the data base to include other types

of substantive information such as event/interaction data.

CASCON permits a policy analyst to enter data into a computer terminal

interactively for a new conflict during whatever phase was current. Later,

the analyst could retrieve the data. He then could compare a new case with

the prior cases in the data base, and he could discover what possible policy

measures were used or suggested in the prior cases. CASCON thus is useful

to the analyst for case comparison (see Table 1). With its 52 case data

base, CASCON meets an analyst's need for memory of actions and reactions of

the foreign environment. Through the comparison of factors in various

cases, CASCON also can aid the evaluator and planner in the identification

of a potential new conflict.

CASCON may be helpful in several of the policy activities outlined

in Table 3. Although CASCON itself cannot aid in the reporting function, it

is a product of reporting and contains central collections of observations.

CASCON may be useful in anticipating environments. For example, by comparing

the pre-hostilities phases of a present conflict with the pre-hostilities

phases of other relevant prior cases, it may be possible to anticipate the outbreak of hostilities. CASCON can list measures that in the past have been successfully manipulated to alter the outcome of a conflict situation. CASCON, thus, is an aid to the memory and imagination of the analyst in the design stage of the policy process.

The above discussion suggests that CASCON can be used in most stages of the policy process outlined in Table 2. CASCON may be useful in the problem/task recognition, problem and option definition, and advocacy of options stages, but it also may be directly applicable to the evaluation stage. CASCON affords a systematic comparison of prior cases on the factors involved in each conflict and the measures used in modifying each factor.

The author, Michael Mihalka, and Lewis Snider are developing a companion system to CASCON at The University of Michigan: CACIS--the Computer Aided Conflict Information System (see Tanter, 1971). Like CASCON, CACIS has an extensive retrieval system. CACIS, however, has more of a modelling capability than CASCON, with great stress on a process model of organizational decision-making.

Similar to the Alker-Christensen computer simulation, CACIS relies on the concept of precedent search in its retrieval system. That is, a party in a conflict seeking a solution based on his goals, will search for historical precedents similar to the current one in order to obtain policy guidance. Precedent search behavior, moreover, assumes the existence of decision rules, e.g., criteria guiding the search, as well as the identification of dimensions of simularity and differences along which one can locate conflicts.

An important aspect of CACIS is an information retrieval system in which there are data about major power conflicts. Such information will include

data on both attributes of actors and event/interactions. International inter-
actions are being coded according to type of action, resource used, originator,
target, action intensity, etc. The system ultimately will contain data on
attributes of nations as well as on their behavior. For example, the system
will contain up-to-date information on such indicators as perceptions of
other nations, military strength, economic conditions, domestic unrest, etc.
In this manner, CACIS intends to address the multiple streams of evidence
portion of the confidence criterion of policy relevance.

CACIS builds on and supplements CASCON's pioneering lead. Whereas
CASCON focuses on local conflicts between small powers or between small
powers and only one major power participant, CACIS includes those conflicts
involving more than one major power, with the CASCON local conflicts as well.
See the list of local conflicts for CASCON in Table 4 and the tentative list
of major power conflicts for CACIS in Table 5 below.

While CASCON achieves its purposes very nicely with one partial model
for organizing in_ rmation on local conflicts, CACIS has several models being
programmed into its system. With CACIS, a policy analyst could seek to es-
tablish and forecast behavior using a variety of models (for example, event/
interaction, bureaucratic politics, and game theory models) and test the
various outcomes with prior and simulated cases. With this feature, CACIS
may approach the deductive power with empirical applicability portion of the
confidence aspect of policy relevance.

The CACIS design consists of separate yet interrelated modules which
include the following:

(1) a memory module which stores information about prior conflicts.

(2) an experience module which stores evaluations about past strategies
and outcomes

Table 4
List of Local Conflicts in CASCON Data Base

1. A.len (South Yemen): 1963-1967

2. Algerian Civil War: 1954-1962

3. Algerian-Moroccan Conflict: 1962-1963

4. Angolan Conflict: 1950-1961

5. Arab-Israel War: 1967

6. Bahrain: 1970

7. Bay of Pigs: 1960-1961

8. Bolivian Conflict: 1967

9. Congo (Katanga): 1960-1963

10. Cuban Insurgency: 1952-1959

11. Conflict on Cyprus (Enosis): 1954-1959

12. Cyprus (Communal): 1960

13. Dominican Republic Conflict: 1963-1965

14. Dominican Republic-Haiti: 1963

15. Ecuador-U.S.A.: 1963

16. El Salvador-Honduras: 1969-1970

17. Ghana-Upper Volta: 1963-1966

18. Greek Insurgency: 1944-1949

19. Guatemala Conflict: 1953-1954

20. Guinea-Ivory Coast: 1966-1967

21. Guinea-Portugese Guinea: 1963-1970

22. Guyana-Venezuela: 1962-1970

23. India-China Border Conflict: 1954-1962

24. India-Pakistan: 1965-1966

25. Indonesian-Malaysian Confrontation: 1963-1965

26. Indonesian War of Independence: 1945-1949

27. Iraq-Kurds Conflict: 1959-1963

28. Kashmir Conflict: 1947-1949 (The Kashmir Conflict: 1949-1965,
    although part of the M.I.T. studies, is not
    included in CASCON.)

29. Kuwait-Iraq Conflict: 1961

30. Laos: 1957-1962

31. Lebanon Conflict: 1958

32. Malayan Emergency: 1948-1960

33. Morocco-Mauritania: 1957-1970

34. Morocco-Spain: 1956

35. Muscot-Oman: 1955

36. Nicaragua-Costa Rica: 1948-1956

37. Nicaragua-Honduras: 1957-1960

38. Nigeria (Biafra): 1967-1970

39. Palestine: 1947-1949

40. Panama-U.S.: 1964

41. Philippines-Huk Conflict: 1946-1954

42. Quemoy-Matsu Conflict: 1954-1958

43. Sinai Conflict: 1956

44. Somalian-Ethiopian-Kenya Conflict: 1960-1964

45. South Tyrol: 1957-1969

46. Soviet-Iranian Conflict: 1941-1947

47. Suez Conflict: 1956

48. Syria-Turkey: 1956-1957

49. Trieste: 1945-1954

Table 5

Tentative List of Major Power Conflicts in CACIS Data Base

1. All conflicts in the CASCON data base

2. North Korean attack on South Korea, June 1950

3. The People's Republic of China entrance in the Korean War, October 1950

4. U.S. decision not to intervene in Indochina in 1954

5. Austrian Peace Treaty 1948-1955

6. The Berlin conflicts

    a. The blockade of 1948-49

    b. The diplomatic ultimatum of November 1958

    c. The Berlin Wall in August 1961

7. The U.S. decision to increase assistance to South Vietnam in 1961

8. The U.S. decision not to intervene militarily in Laos, 1960-61

9. The Cuban Missile Crisis of October 1962

10. The U.S. decision to escalate in Vietnam, 1965-68

11. The U.S. decision to enter Cambodia, Summer 1970

12. Communist takeover of Czechoslovak government, 1948

13. Soviet intervention in Czechoslovakia, 1968

14. Soviet intervention in Hungary, 1956

15. People's Republic of China anticipation of U.S.-Taiwan invasion in 1962

16. Chinese Civil War, 1946-49

17. Indochina Conflict 1946-54

18. Sino-Soviet border disputes 1958-present

(3) an _involvement_ or stakes module which provides information about the type and intensity of interests an actor has in a specific conflict.

(4) an _operational environment_ module which includes information on both the international environment and the internal domestic policy-making environment of the actors.

The modules of CACIS include manipulables. The modules present the policy analyst and planner with a range of possibilities within their control, both obvious and non-obvious. CACIS allows them to assess the interrelationships among policy options, and it allows tests of the various proposed options. CACIS could be of particular usefulness in the study of crisis in the international system. Specifically, CACIS should aid in distinguishing crisis periods from non-crisis periods, and in the study of decision-making and planning under crisis. CACIS, by thus addressing several criteria for policy relevance in its model building and conflict management efforts, also should allow for the validation of its models through their utilization in the policy process.

Similar to CASCON, CACIS could be a helpful problem solving and policy analysis tool for most of the users listed in Table 1. F example, a policy analyst could use CACIS to help determine a "normal" pattern of event/interaction between two nations. Deviations from the norm can alert the analyst that a change in relationships may be in the offing. CACIS, with its modelling capacity, also could be a useful aid to the forecaster. A policy analyst can use CACIS in the tasks listed in Table 3. CACIS is applicable to the task of monitoring implementation, evaluating policies and programs, anticipating environments, and policy design. CACIS could assist the policy analyst by helping him anticipate potential conflicts before they become too intense for calm analysis. CACIS should help the analyst develop appropriate policy measures before the range of alternatives is limited by decreasing time and

increasing intensity, as in a crisis (cf. Hermann, 1969). CACIS seems applicable to a variety of policy tasks and, thus, as a scholarly input CACIS could be useful in many stages of the policy process (see Table 2).

Table 6 summarizes the policy relevance of the four types of models. All of the models discussed offer some hope for scholarly involvement in the policy process, at one stage or another. The types of models used by Riker as well as by Olson and Zeckhauser seem particularly policy relevant according to the criteria in this essay. The design, development, implementation, and utilization of computer based models such as CACIS* also offer a promising strategy for using social science products in government. Such a strategy, however, depends upon progress in other categories of model building such as game theory and experimental games, man-machine simulations, and aggregate data modelling. Drawing upon some of these complementary strategies, computer-based models promise to be policy relevant in terms of the control and confidence criteria of this essay.

*CACIS could not have been created without the pioneering efforts of Charles McClelland and his colleagues in the World Event/Interaction Survey (WEIS) Project.

Table 6: The Policy Relevance of Models in World Politics

| | I. Control | | | II. Confidence | | | | | |
| | 1. Perceived Manipulability | | | 1. Deductive Power with Empirical Applicability | | | 2. Multiple Streams of Evidence | | |
	High	Med	Low	High	Med	Low	High	Med	Low
Game theory models and experimental games									
--zero-sum games, Riker		x		x				x	
--non-zero sum games, Rapeport		x			x				x
Man-machine models and simulations									
--Shure et al.	x				x				x
--Guetzkow et al.		x			x				x
Aggregate data models									
--Richardson	x			x				x	
--Olson & Zeckhauser	x	x			x			x	
--Kato		x			x				x
Computer simulation models and information systems									
--Alker, Christensen, and Greenberg		x			x			x	
--CASCON, Beattie and Bloomfield	x					x			x
--CACIS, Tanter, Mihalka, and Snider	x				x				x

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